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Soil Micronutrient Status in Hazro Area of District Attock, Pakistan

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Abstract. Study of micronutrients in the soil of Hazro area of District Attock (Potohar), Pakistan, revealed micronutrient deficiency in the order of Fe> Mn> Zn> Cu. All the soils were low to medium in Fe and Mn followed by Zn content, whereas only 8% samples had low Cu content. 92% and 18% soils in Hazro area had satisfactory to adequate Cu and Zinc contents, respectively, Thus soils were deficient in Fe, Mn and Zn, whereas Cu was in medium to adequate range.

Keywords: micronutrients, Hazro, soil micronutrients, Attock

Introduction

Micronutrients are as important in plant nutrition as the macro nutrients and plants grown on soils deficient in micronutrients can exhibit similar reduction in growth and yield (Havlin *et al.*, 2004). To get optimum yield, a balance dose of macro as well as micronutrients are required. Deficiency of various micronutrients is related to soil type and crop. The introduction of new high yielding hybrids or cultivars demanding a higher level of soil fertility has further accentuated the incidence of micronutrient deficiencies. Zn deficiency is the most widespread disorder in the country. Soil analyses revealed that > 50% of the cultivated soils of the country are unable to provide sufficient Zn to meet the needs of many crops (Khattak, 1995). The information obtained from 329 soil samples collected from various depths throughout the country during the period of seven months revealed widespread deficiency of Zn and B followed by Fe (Zia *et al.*, 2004b).

District Attock of Potohar comprises of six tehsils, i.e., Attock, Hazro, Fatehjang, Pindi Gheb, Jand and Hasan Abdal. The district lies between latitude 32.35° N and longitude 72.55° E. The climate is sub-humid to semi-arid with 400-700 mm annual rainfall. Hazro tehsil is among the most productive tehsils of Attock with sizeable contribution to agriculture. The soils of Hazro are medium (loam) to light (sandy loam) textured with most of the soils poor in fertility status (Mehmood *et al.*, 2008).

Keeping in view the low fertility, nutritional disorder and importance of micronutrients for successful cropping in Hazro area, a study was conducted to assess the extent of micronutrients *viz.*, zinc, iron, copper and manganese deficiencies in soils of Hazro area of District Attock.

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Materials and Methods

Soil samples were collected from different field locations of Hazro area of District Attock, air dried, sieved and stored in plastic bottles. Samples were analyzed by diethylene triamine pentacetic acid (DTPA) extraction method. Twenty (20) grammes of soil were shaken with 40 mL of 0.005 M DTPA solution for 2 h, and double filtered with Whatman filter paper # 42. A series of standard DTPA extraction solutions for micronutrients were also prepared. Zn, Fe, Cu and Mn were measured directly in the filtrate and the standard solutions by atomic absorption spectrophotometer using appropriate lamp for each element (Ryan *et al.*, 2001).The data was subjected to statistical analysis in MS Excel-2007.

Soil micronutrients have been characterized (Table 1) according to the generalized guidelines (Martens and Lindsay, 1990) used for interpretation of soil micronutrient analysis data in Pakistan (Zia *et al.*, 2004a).

Table 1. Guidelines for interpretation of soil micronutrient status

Parameters	DTPA extractable micronutrients (mg/kg)		
	Low	Medium	Adequate
Zinc	< 0.5	0.5-1.0	> 1.0
Iron	< 4.5	-	> 4.5
Copper	< 0.2	-	> 0.2
Manganese	< 1.0	1.0 – 2.0	> 2.0

Results and Discussion

Generally, soils of Hazro are light to medium textured, calcareous in nature, having normal pH but low in fertility. Mehmood *et al.* (2008) reported that 74.0% of soils in Hazro tehsil were loam textured while, 99.0% soils had normal pH (7.5-8.5) and EC (< 4.0 dSm^{-1}) status. They also reported that 89.0% and 99.0% soils in Hazro tehsil were poor in organic matter and available phosphorus, respectively.

The results of the micronutrient analyses are given in Table 2 and 3 and Fig. 1 and 2, discussed as under:

Zinc. The data revealed that 41 (62%) soils samples of Hazro area had low to medium while, only 9 (18%) had adequate zinc contents (Table 3). Zn contents were found in the range of 0.32 to 1.40 with a mean value of 0.94 mg/kg at upper soil depth.

Iron. Soils of Hazro area had very low Fe status (Table 2). All the 50 samples had iron content less than the critical value of 4.5 mg/kg. Fe was observed in the range of 1.02 to 2.70 mg/kg with mean value of 1.70 mg/kg at upper 0-15 cm soil depth.

Copper. The data in Table 2 indicated adequate concentration of copper in the surveyed samples. About 92% samples showed adequate, whereas, only 8% had low Cu contents. The range was 0.04-2.16 mg/kg with mean value of 1.32 mg/kg at 0-15 cm soil depth (Fig. 2).

Table 2. Micronutrients in Hazro soil samples

Parameter	DTPA extractable micronutrients (mg/kg)		
	Low	Medium	Adequate
Zinc	10	31	09
Iron	50	-	0
Copper	4	-	46
Manganese	05	45	0

Table 3. The maximum and minimum quantities of micronutrients in Hazro soils

Parameter	Depth (cm)	Minimum (mg/kg)	Maximum (mg/kg)
Zinc	0-15	0.32	1.40
	15-30	0.22	0.32
Iron	0-15	1.02	2.70
	15-30	0.98	2.68
Copper	0-15	0.04	2.16
	15-30	0.02	2.12
Manganese	0-15	0.36	1.90
	15-30	0.32	1.82

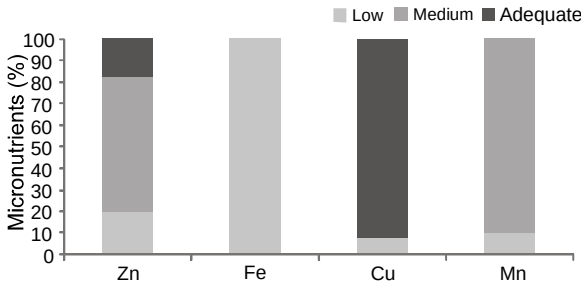

Fig. 1. Micronutrients (%) in soil samples of Hazro area.

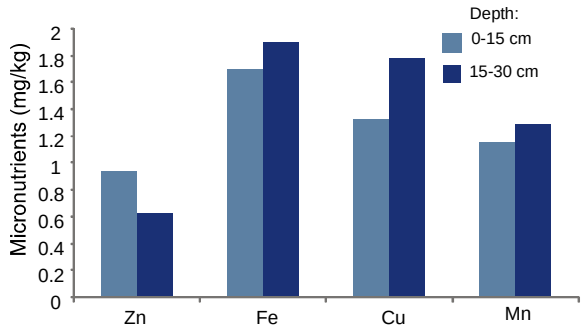

Fig. 2. Mean quantity of micronutrients (mg/kg) in Hazro soils.

Manganese. All the soil samples had low to medium Mn content (< 2.0 mg/kg); 45 (90%) samples had Mn in the medium range (1.0-2.0 mg/kg) with mean value of 1.28 mg/kg.

The results of the present study revealed deficiency of micronutrients in the soil in the order of Fe> Mn> Zn> Cu. The higher Fe, Cu and Mn contents at the depth of 15-30 cm while higher Zn content in the upper 0-15 cm soil layer was observed (Fig. 2).

These are in accordance with Rashid and Qayyum (1990) who encountered Zn and Fe deficiencies in most of the soils of Potohar. Similar results were also reported by Tariq *et al.* (2004) who found that more than 60% of soils in Punjab are deficient in Zn while, Fe deficiency was also observed in most of the soils. However, Rashid *et al.* (1994) recorded none of the fields in Attock deficient in Mn. Micronutrient deficiency is more often observed in high pH, calcareous soils with low organic matter content (Havlin *et al.*, 2004). Presence of low quantities of micronutrients (Fe,

Zn, and Mn) in the study area might be due to alkaline (high pH) calcareous nature of soils and low organic matter in this area. Greater incidence of Fe deficiency and low solubility of soil Fe (Havlin *et al.*, 2004) is encountered in the soils containing $CaCO_3$ in the pH range of 7.3-8.5. The deficiency of available Fe and Mn may also be attributed to the antagonistic effect of Zn fertilizer application (Imtiaz *et al.* 2003).

Conclusion

Deficiency of Fe, Mn & Zn was observed in the Hazro area soils in the Attock District, whereas Cu was in the satisfactory range.

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